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1 Introduction

In this paper I discuss the semantic consequences when a superlative phrase appears inside a relative clause. In such cases, the relative clause seems to be able to take on a nonintersective denotation, a situation which contradicts common assumptions in the semantic literature that relative clauses are always intersective.

Thus, consider (1):

- (1) I met the man who climbed the highest mountain.

(1) has an absolute superlative reading where it entails that I met the (unique) man who climbed Mt. Everest, but it also has a comparative superlative reading where it entails that I met the man who climbed a mountain higher than any mountain any other man climbed. For this latter reading we seem to want a denotation as in (2b):

- (2) a. [who climbed the highest mountain]
b. (Denotation of (2a)): $\lambda P_{\langle e, t \rangle} \lambda x_{\langle e \rangle} . P(x) \ \& \ \exists z [z \text{ is a mountain} \ \& \ x \text{ climbed } z \ \& \ \neg \exists y [P(y) \ \& \ \exists w [w \text{ is a mountain} \ \& \ w \text{ is as high as or higher than } z \ \& \ y \text{ climbed } w]]]$

Evidence that the comparison class *necessarily* depends on the head noun, rather than some contextual restriction, comes from quantified head NPs.

- (3) Every coach_k praised the player of his_k who played the best game.

(3) has a reading where each coach has a different set of players, each set containing a player who played a better game than any other player in that set. This requires that for each coach, the comparison class for the corre-

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sponding player must be the other players of that coach's team. Thus, a fixed value for the comparison class is impossible.

Focus sensitivity illustrates the same point. (4) has a reading which presupposes that there are other relevant individuals (e.g. women) such that one of them climbed the highest mountain of the women, and possibly a higher mountain than the man I met climbed.

- (4) I only met the MAN who climbed the highest mountain.

In the upcoming sections I present an analysis of this paradigm, extending the available theory of relative clauses on the one hand, and the comparative reading of the superlative construction on the other, to correctly predict these cases. I do this by allowing the argument corresponding to the comparison class to be a variable in the syntax that can be bound by the head noun. In section 2 I detail this analysis. In section 3 I enrich the analysis to encompass cases where the comparison class can be restricted further than the denotation of the head noun. In section 4 I discuss a further prediction which my analysis makes, dealing with superlatives in the restrictor of *every*. Section 5 discusses some loose ends, while section 6 offers a brief conclusion.

2 The Bound Comparison Class

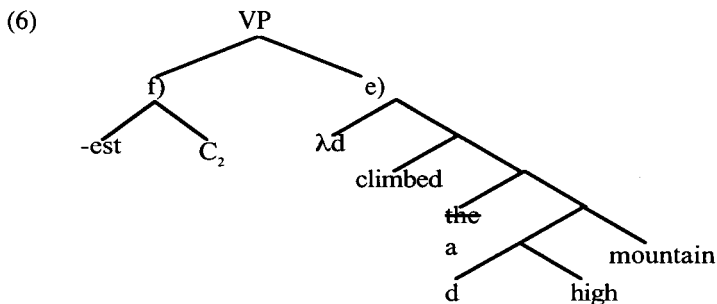
In this section I present the initial analysis of the comparative reading of a superlative in a relative clause. I will build on Heim's (1999) analysis of the comparative reading of the superlative in general. To that end, section 2.1 briefly reviews that analysis. In section 2.2, then, I show what has to be done to account for examples like (1), when the relative clause has a reading as in (2b).

2.1 The Comparative Reading of the Superlative

Consider the two readings of (5), one paraphrased in (5a) and the other paraphrased in (5b).

- (5) John climbed the highest mountain.
- a. Comparative reading: No one climbed a mountain as high as or higher than the mountain John climbed. (But perhaps John didn't climb Mt. Everest.)
 - b. Absolute reading: John climbed Mt. Everest.

Heim analyzes the comparative reading of a sentence like (5) as involving a contextually supplied set of individuals, C , which represents the comparison class for the superlative (see also Farkas and É Kiss (2000) and Szabolcsi (1986)). We work from the structure in (6), derived from the surface structure by LF movement of the superlative morpheme *-est*.



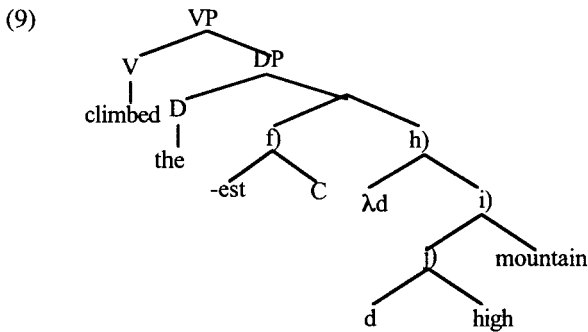
Here, C_2 refers to the set of contextually-relevant people who have climbed mountains. Node $e)$ denotes a relation of degrees to individuals, mapping a degree d to the set of individuals who climbed a d -high mountain. The word *the* is semantically changed to *a* in order to get the right semantics. Node $f)$, the morpheme *-est* combined with the comparison class (which is a set of individuals) is a relation between individuals and relations between degrees and individuals. So the *-est* morpheme denotes as in (7). The entire VP in (6) denotes as in (8).

(7) (denotation of *-est*): $\lambda P_{\langle e, t \rangle} \lambda R_{\langle d, t \rangle} \lambda x. \exists d [R(d)(x) \ \& \ \neg \exists y [P(y) \ \& \ R(d)(y) \ \wedge \ y \neq x]]$

(8) (denotation of (6)): $\lambda x. \exists d [x \text{ climbed a } d\text{-high mountain} \ \& \ \neg \exists y [C(y) \ \& \ y \text{ climbed a } d\text{-high mountain} \ \& \ y \neq x]]$

In this way, (8) is a predicate of individuals which climbed a mountain higher than that which any other person in C climbed.

For the absolutive superlative reading, by contrast, the superlative morpheme scopes under the verb, and just above the object (9). Thus we have the $h)$ node denoting a relation between degrees and sets of mountains, mapping a degree d to the set of *mountains* that are d -high. Node $f)$ takes scope over this and we are left with the set of mountains which are higher than any other mountain.

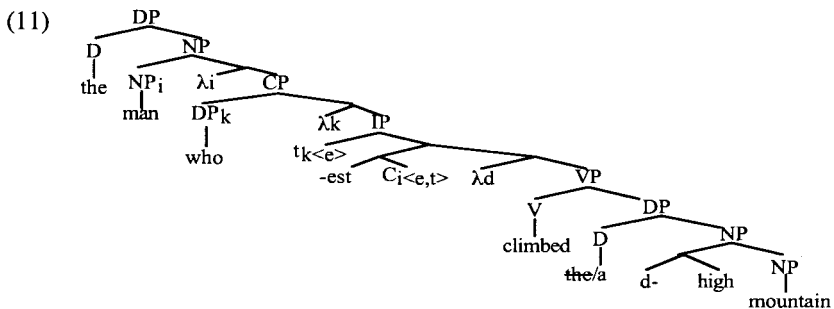


2.2 Bound Comparison Classes

In this section I propose to extend the schema of Heim's analysis to the relative clause case. The idea is for C, which is a contextually given set for Heim, to be *bound* by the head noun. Schematically, what we want is a situation as in (10), where the comparison class receives its interpretation from the head noun, so that in this case the climber is compared with other men.

- (10) man₄ . . . who climbed the highest (C₄) mountain.

To implement this idea, I will assume that the head noun can bind the comparison class, where the latter is a variable of type $\langle e, t \rangle$. Applying this to a Heimian structure for a comparative superlative (with lambda abstracts for binders added as in Heim and Kratzer (1998)), we arrive at (11). Here, the head noun binds the comparison class variable, C.

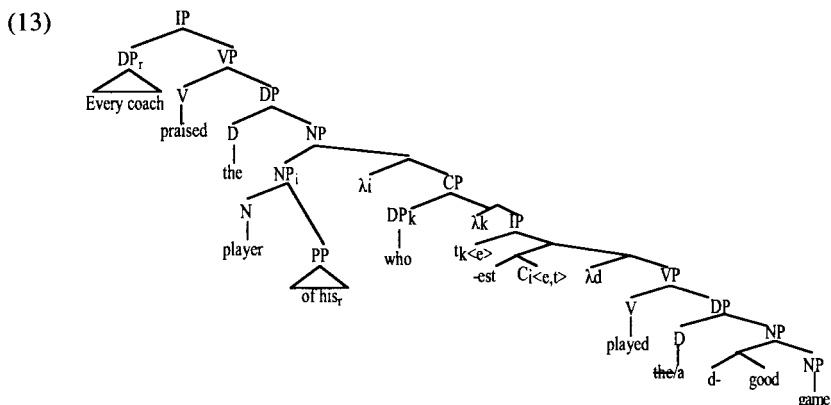


Thus, when *man* in its surface position combines with the relative clause, the lambda abstract λi semantically binds the comparison class variable. The resulting interpretation for the CP, before combination with the head noun (but after predicate abstraction), is (12). Here I slightly amend Heim's semantics, adding the first " $P(x)$ " term; this is here for technical reasons, to ensure that, for example, *man who climbed the highest mountain* is in fact a subset of men, and not just a set of *things* which climb a mountain higher than any *man* climbed; this seems to accord with our intuitions.

- (12) a. Semantics for CP: $\lambda P_{\langle e, t \rangle} \lambda x_{\langle e \rangle} . P(x) \ \& \ \exists z[z \text{ is a mountain} \ \& \ x \text{ climbed } z \ \& \ \neg \exists y[P(y) \ \& \ \exists o[o \text{ is a mountain} \ \& \ o \text{ is as high as or higher than } z \ \& \ y \text{ climbed } o]]]$
 b. Semantics for NP: $\lambda x_{\langle e \rangle} . x \text{ is a man} \ \& \ \exists z[z \text{ is a mountain} \ \& \ x \text{ climbed } z \ \& \ \neg \exists y[y \text{ is a man} \ \& \ \exists o[o \text{ is a mountain} \ \& \ o \text{ is as high as or higher than } z \ \& \ y \text{ climbed } o]]]$

To take a complex example, (3), repeated here, will be analyzed as in (13). The head NP contains the bound pronoun *his*; therefore its interpretation varies with quantification. This in turn causes the interpretation of the comparison class, *C*, to vary with the quantification, since it is bound by the head NP. We then get the reading we want, where the player that each coach praised was better than any other player associated with that particular coach.

- (3) Every coach_k praised the player of his_k who played the best game.



The analysis here suggests that the comparison class, which is normally determined contextually, is determined in the syntax in some cases. Variables which vary with quantification, but which without quantification are determined by the context, have been observed e.g. by Mitchell (1986) with “local bar” examples (14) and by Stanley and Szabo (2000) for examples where the contextual domain for quantification varies with a higher quantifier (15).

- (14) a. John went to a local bar. (locality determined by discourse)
- b. Every man in the country went to a local bar. (locality determined by context which varies with men)
- (15) a. The teacher failed every student. (universe of students determined by context, presumably one class)
- b. Most of the teachers failed every student. (universe of students different for each teacher)

3 Variable Comparison Classes

In this section we note an apparent challenge to the theory advanced in section 2. The bound comparison class analysis predicts that the comparison class for each relevant individual in the superlative will be identical in denotation to the head noun. However, in some cases, it seems that the comparison class has to be a subset of the denotation of the head noun. Consider the following situation:

- (16) a. The school board of a state holds a contest to reward the student who can bake the biggest cake. The individual schools hold local contests first.
- b. Every school sent the child who baked the biggest cake to compete in the finals.

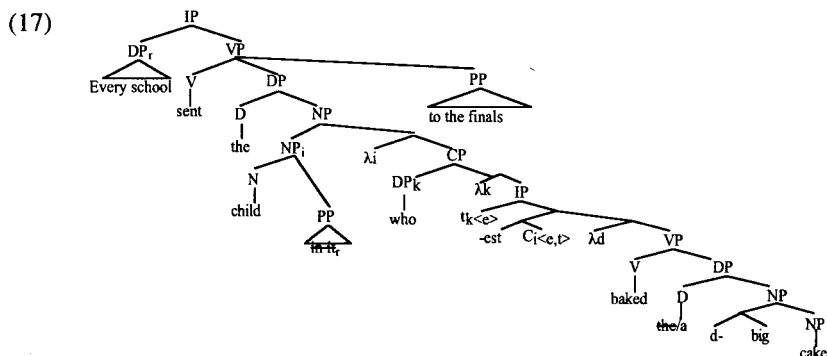
In the situation in (16a), unlike that in (3), the most natural comparison class for the superlative in (16b) is the set of children in each finalist’s respective school, not the set of relevant children in general. So it seems the comparison class of the superlative varies with quantification independently of the head noun.

3.1 Extending the Bound Comparison Class

Within the theory presented in section 2, we can suggest that the head noun phrase can have a silent restrictor, parallel to the overt restrictor in (3) *of his* on the noun, which can be bound by higher quantification:

(16b') [Every school]_k sent the [child ~~in it~~_k]_i who baked the biggest [_{C_i}] cake to compete in the finals.

The syntactic representation that gives rise to this interpretation is given in (17).



3.2 A Possible (but Problematic) Alternative: A Contextual Function

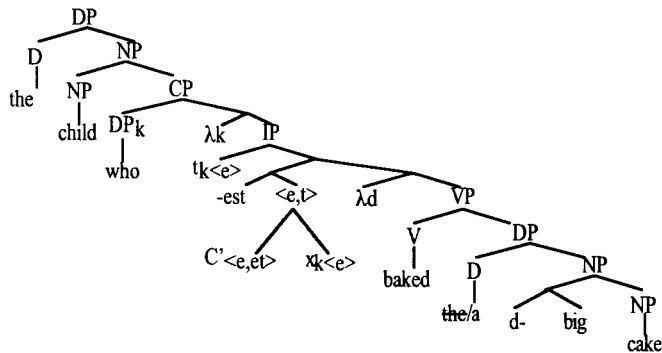
We could imagine a different analysis to account for the variability of the comparison class, as in (16). Instead of a set of individuals, the context could supply a function from individuals to sets of individuals:

(18) Let $C' = \lambda x. \{y: y \text{ is a member of the relevant comparison class for } x\}$

C' will combine with a silent pronominal, signified by “ x ”, bound by the trace of the relativized DP to yield the comparison class for the individual (19). If the DP is quantified, then the comparison class will vary with the individual being considered. The output of C' , and the manner in which it is dependent on the argument of the function, is given by the context.

(19)

(alternative)

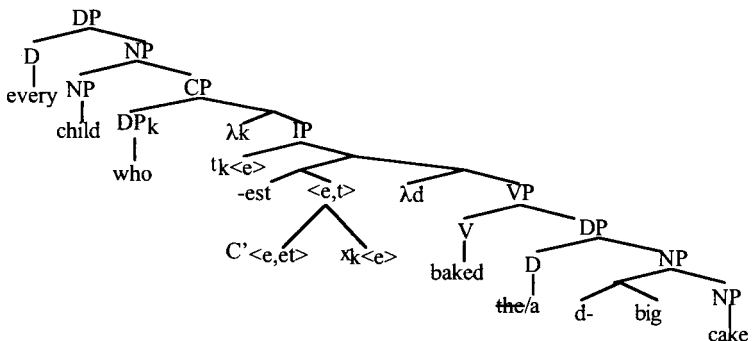


Note that in this analysis, the relative clause is not nonintersective any more. Its interpretation simply varies. The apparent subsectivity results from some cases of $C'(x)$ which happen to coincide with the head noun. However, this analysis predicts that (20) should be good (picture the situation in (16a), repeated here):

- (16) a. The school board of a state holds a contest to reward the student who can bake the biggest cake. The individual schools hold local contests first.

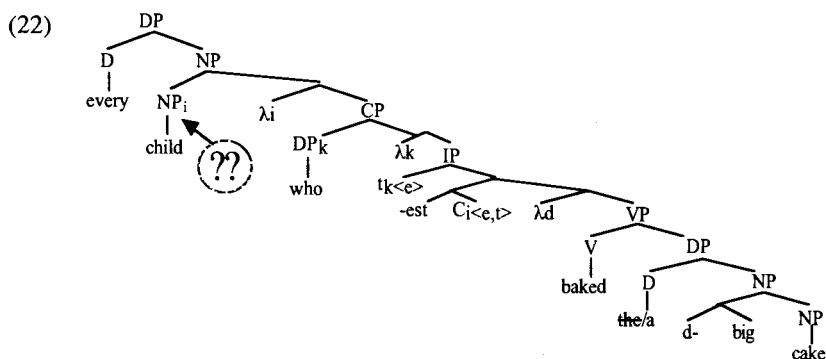
(20) ?*Every child who baked the biggest cake went to the finals.

(21)



(20) is predicted to be fine because, in (21), the relative clause comes to mean “children who bake the biggest cakes in their contextually defined context sets”, which should have no problem being quantified over by *every*.

On the other hand, the analysis defended in this paper predicts (20) to be bad:



The only thing that the highest NP can denote is the child who baked the biggest cake among children. Unlike the case of (16b), when the quantification was higher up, here there is no chance of having a contextual restriction on the head noun, since there would be nothing to bind it. (23a) denotes a unique individual. This situation, with *every NP* where NP denotes a singleton, seems to result in oddness, as in (23b-c).

- (23) a. [_{NP} child who baked the biggest cake]
 b. #Every highest mountain is in the Himalayas.
 c. #Every nose on John's face is red.

In the next section we note that the bound comparison class analysis makes correct predictions for cases of quantification with absolutive superlatives where the comparison class varies with quantification.

4 Quantification and Absolutive Superlatives

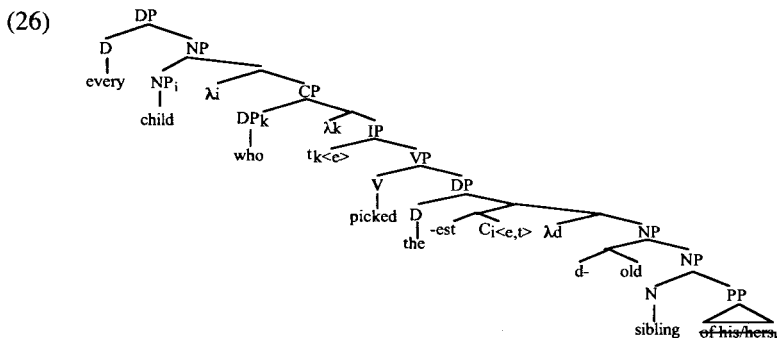
We can construct cases which are similar to those discussed in section 3.2, but which contain absolutive superlatives (24). These sound much better than those with comparative superlatives (25).

- (24) a. Several children were placed in a psychological study. They were told to picture all of their siblings, and then pick one of their siblings at random.
 b. Every child who picked the oldest sibling was flagged for further study.

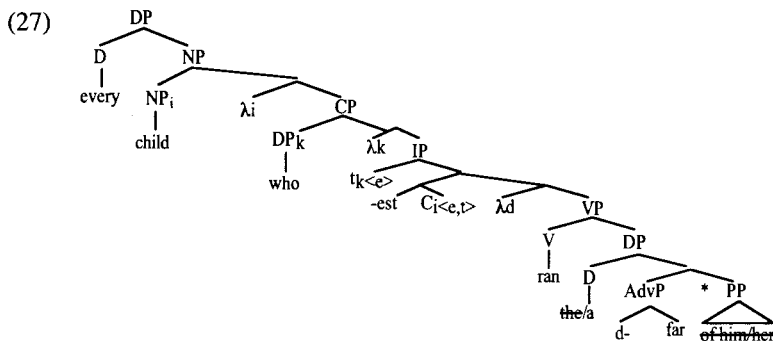
- (25) a. Several groups of children were asked to run any distance they liked.
 b. ?*Every child who ran the furthest was flagged for further study.

(24b) seems fine in a context where each child is picking the oldest of a different set of siblings, namely his or her own. Note that this is an absolutive superlative within the quantification, since no child is being compared with other children who picked siblings from his comparison class. (25b), on the other hand, involves a comparative superlative.

We can analyze (24b) by placing a contextually bound silent pronoun in the object itself:



This would not be available in the comparative reading of the superlative, because the relation required would be more complex than the syntax provides. As shown in (27), we would need a restrictor like "of him/her", which would be a vague mapping from the individual quantified over to the relevant comparison class.

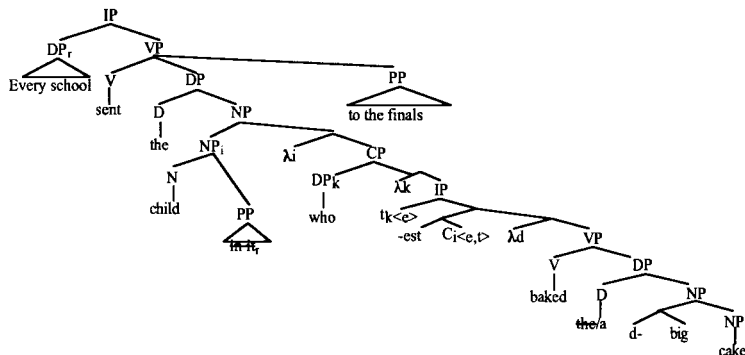


5 Loose Ends

One further prediction of the theory presented here, which is again not made by the theory presented in section 3.2, is that while the comparison class can be a *subset* of the denotation of the head noun, it can never be a *superset* of the head noun, or be completely unrelated. This is because our solution to the problem presented by (16), repeated here, that the comparison class wasn't identical to the head noun, was that there was a covert syntactic restrictor on the head noun.

- (16) a. The school board of a state holds a contest to reward the student who can bake the biggest cake. The individual schools hold local contests first.
 b. Every school sent the child who baked the biggest cake to compete in the finals.

(17)



Given this analysis, there is no way to get the comparison class for each individual to be *greater* than the set of children, but still vary with quantification. The examples are difficult to construct. The relevant situation would be something like (18):

- (18) a. The school board of a state holds a contest to reward the student who can bake the biggest cake. The individual schools hold local contests first. It happens that a female student won each contest.
 b. Therefore, every school sent the girl who baked the biggest cake to compete in the finals.

In (18b), the head noun of the relative clause is *girl*, but the relevant comparison class is supposed to be ‘students in the school’. If this example is good, then it would perhaps show that the comparison class can vary with quantification, and in each case, refer to a *superset* of the set denoted by the head noun. This would not be predicted by the theory advocated here, but it would be predicted to be possible by the theory present in section 3.2.

The example seems ok. However, it is difficult to tell whether comparison class in (18b) really is ‘students in the school’, rather than ‘girls in the school.’ If it is ‘girls in the school’, then (18b) will be just as true in the situation delineated by (18a).

An attempt to get around this is to use negation. Consider the situation in (19):

- (19) a. There was a “eat-the-biggest-tomato” contest. There was a man who ate a bigger tomato than any other man. But it happens that a woman won the contest; of all the men and woman, Mary ate the biggest tomato.
- b. Therefore, there is no man who ate the biggest tomato.

If (19b) has a reading where it is true, then this might be interpreted as a reading where the comparison class for the superlative is “contestants”, not just men. However, in this example the comparison class may simply not be bound by anything, and then this wouldn’t be a counterexample to the theory presented here for what happens when comparison classes *must* be bound (as with quantification). Additionally, it is hard to rule out the possibility that (19b) uses the absolutive reading for the superlative. I must leave a more careful exploration of these facts, and hence evaluation of this prediction, to future research.

6 Conclusions

We have seen that comparison classes for comparative superlatives must have the option to be bound in some way when they occur in relative clauses. They can vary with quantification, with focus, etc. I have noted that an alternative theory, which does not employ such binding but merely involves binding of individual variables, makes wrong predictions. The implication is that syntactic and semantic binding is quite a pervasive phenomenon in natural language, and extends to set denotations (NPs) as well as individual denotations.

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